

that there are security concerns with enabling CLECs to access Verizon's network to perform maintenance testing functions in a GR-303 environment.¹²⁶ This, however, is to make regulatory mountains out of technical molehills. Tr. 4616 (Riolo).

An entrant constructing a new network would employ exclusively GR-303 because its economic advantages dwarf the expenditures needed to resolve the minor technical obstacles that exist – and manual workarounds could be used in the interim if needed. **[BEGIN**

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¹²⁶ In its surrebuttal testimony, Verizon asserts that “AT&T/WorldCom’s suggestion that IDLC unbundling could be resolved by simple OSS developments or manual ordering avoids entirely the far more significant technical issues that must be resolved before such unbundling can be provisioned at all.” Verizon Exh. 122 (Verizon Recurring Cost Panel Surreb.) at 80 n. 67. But, as noted above, Verizon acknowledges that GR-303 loops can be unbundled, and that only OSS and security issues are a concern.

In fact, NYNEX's 1997 Technical Document, concurred in by Mr. Gansert, stated that GR- 303 (then called TR-303) would likely play a key role in unbundling and that Verizon could employ TR-008 methods of unbundling (without any UDLC) until the industry developed multi-hosting capabilities for GR-303. AT&T Ex. 120 at 4. The document described three methods of unbundling using TSI with TR008 and GR-303 and described the OSS for doing so. *Id.* at 4-6. The document also described architectures for unbundling and non-switched services and stated that "[t]he additional steps required for flowing through the TSI change have been demonstrated to be technically and operationally feasible (a successful Operations "FOA" was conducted in NET in 1995). The software presently in the NYNEX Operations Systems that allow for 'flexible' TSI flow-through were put through their paces and found acceptable for operations deployment." *Id.* at 7. A diagram of the OSS was provided on page 8.

While hiding behind the claimed difficulty of developing OSS for unbundling, Verizon fails to explain why developing OSS for unbundling GR-303 loops would be difficult.¹²⁷ As the AT&T/WorldCom Cost Panel stated, there are no significant technical barriers to developing this OSS. AT&T/WCOM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 29-30. And Verizon has not pointed to any such barriers. Indeed, since the Telecommunications Act passed in 1996, the Commission frequently has ordered ILECs to provide unbundled elements with the OSS for that unbundling. The ILECs – in cooperation with the CLECs – have been able to develop that OSS. Tr. 4615 (Riolo). The OSS for GR-303 is no more complicated – and indeed less complicated given that the OSS for ordering other UNEs has

¹²⁷ Certainly there is no need to deploy UDLC. The 1997 NYNEX document, concurred in by Mr. Gansert, states that "the TR 008 systems already in service can, if equipped with a TSI, provide the needed unbundling capabilities using a DS-1 interface. This unbundling mechanism is fully supported by Operations Systems (OSS's) and is the recommended and preferred option." AT&T Ex. 118 at 4. Telcordia also describes the use of TR-008 for unbundling without posing any limitations concerning OSS or security. AT&T Exh. 122, Telcordia Notes on the Network, Oct. 2000 at 12-56.

already been developed. In fact, Verizon has had to resolve OSS issues with respect to its back-end systems to deploy GR-303 outside the context of unbundled loops. Verizon resolved these issues once it decided to deploy GR-303. Tr. 4587 (Gansert) (stating that OSS for GR-303 had been developed for the LEC environment). Where it has decided to deploy a significant amount of GR-303 – in Verizon West – Verizon has not only resolved these difficulties but also shown the OSS works in practice. Verizon could easily develop the OSS for ordering unbundled GR-303 loops as well.

And even if fully electronic OSS could not immediately be developed, it would make sense in a reconstructed network to deploy GR-303 and use manual ordering processes for UNE loops in the interim. Tr. 4615 (Riolo). Verizon does not dispute this possibility. Indeed, when NYNEX originally determined to deploy GR-303 technology, it did so even though “[s]ome manual intervention is required until the first half of 1996 when BellCore’s SWITCH OS is available.” AT&T Ex. 123, *Telesector Resources Group Technology and Network Planning*, Dec. 29, 1993, at 9. [BEGIN VERIZON PROPRIETARY]

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The security issue is also a red herring. In theory, the security concern is that if competitors have access to Verizon's network to test unbundled loops for maintenance and other purposes and these loops are concentrated with other loops, then competitors could use their access to switch customers to their network. Moreover, there may be technical difficulties in enabling multiple carriers to use their OSS to monitor alarms, conduct testing, *etc.* In essence, this is a restatement of the need to develop OSS that will work in a multi-carrier environment. But similar concerns have existed with other technologies and have been readily resolved. Again, Verizon has acknowledged facing security concerns in deploying GR-303 for loops used

for retail customers in Verizon West and has resolved those concerns. Tr. 4166-68 (Gansert). Moreover, to the extent that competitors' access to the ILECs' network to perform maintenance functions is the difficulty, Verizon could simply charge CLECs to perform these functions for them.¹²⁸ Tr. 4615-16 (Riolo). This would still be far more efficient than deploying any UDLC in the network.

The real issue is that, because Verizon has chosen to deploy relatively little GR-303 in its existing network—due to the technological constraints of its embedded switch investment—Verizon has lacked the incentive to work with vendors on GR-303. AT&T/WCOM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 29-30. This is especially true with respect to the OSS and security issues that would be useful in supporting GR-303 unbundling. Indeed, so long as Verizon is able to argue for higher UNE prices on the theory that GR-303 unbundling is not yet available, it has every incentive *not* to develop the OSS and security that would support such unbundling.¹²⁹ Verizon should not be allowed to profit from this approach.

Contrary to Verizon's suggestion, Verizon Exh. 122 (Verizon Recurring Cost Panel Surreb.) at 81, the Commission's requirement that costs be based on the most efficient technology commercially available today does not counsel a different result. The most efficient

¹²⁸ Mr. Gansert was unable to identify any security concerns an ILEC would face with the use of GR-303 for unbundling if CLECs were not given access to the virtual interface groups in the system. The only concerns he identified were ones that Verizon would face even in the absence of unbundling and that have not precluded Verizon from deploying GR-303 in Verizon West. Tr. 4166-68 (Gansert).

¹²⁹ In its surrebuttal testimony, Verizon states that it provided a price quote to WorldCom for completion of the necessary technical work for unbundling loops with GR-303. Verizon Exh. 122 (Verizon Recurring Cost Panel Surreb.) at 79-80. This demonstrates that Verizon knows that any technical issues can be resolved for a price, and Verizon does not even say that the price would be particularly high. The fact that WorldCom did not take Verizon up on its offer in 1999 – at a time when Verizon had not deployed any significant amount of GR-303 in its network merely shows that WorldCom did not want to pay any amount to develop OSS for GR-303 unbundling when almost no GR-303 existed to be unbundled as a result of Verizon's deployment of TR-008 and UDLC.

technology currently available today is GR-303. The need to make minor modifications to OSS to allow for electronic ordering of unbundled GR-303 loops does not mean this technology is not available. Minor modifications are often needed to deploy any technology. The requirement that technology be currently available simply means that the technology must be one that a new entrant would choose if it were constructing a network today. There is no doubt that a new entrant would choose GR-303 and would work with vendors to eliminate any minor OSS or security issues that might initially hinder the most efficient use of GR-303 technology.

Finally, it is important to note that Verizon does not even state what amount of UDLC it believes is appropriate for use in the Synthesis Model. In its rebuttal testimony, Verizon simply argues that GR-303 cannot be used for 100% of fiber-fed loops because of technical issues associated with unbundling and non-switched services in a multi-carrier environment. Verizon Exh. 109 (Murphy Reb.) at 26-27.¹³⁰ But Verizon does not propose any modification to the Synthesis Model as a result. Certainly, it would be inappropriate to substitute the input from Verizon's models. Verizon proposes a mix of UDLC and IDLC that reflects Verizon's installation over the *past* three years in its embedded network, which is intended to serve as a surrogate for the amount of UDLC and IDLC Verizon expects to deploy over the next three years. *Id.* at 25, 27. But this deployment resulted, at least in part, from the constraints of Verizon's embedded network. AT&T/WCOM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 22-23. Verizon makes no effort to show that the **BEGIN VERIZON PROPRIETARY *** [REDACTED] *** END VERIZON PROPRIETARY** UDLC it includes in its models is necessary to provide non-switched services or unbundled loops (even if such services could not be provided using GR-303). Verizon has not attempted to calculate how much UDLC would be needed for such purposes; it also has not compared the amount of UDLC deployed in

¹³⁰ Verizon does not even argue for use of any TR-008 in the Synthesis Model, as the only reason Verizon deployed TR-008 in its own models is the constraints of its own network.

Virginia with the amount deployed in other states, and it has not isolated new switches to determine the mix of UDLC, TR-008 and GR-303 deployed in those switches, which are less constrained by Verizon's existing network. Tr. 4149 (Gansert). In fact it is highly unlikely that the amount of UDLC proposed by Verizon for use in its own models would be needed even if UDLC were used to provide service for all relevant non-switched services and all relevant unbundled loops.¹³¹ Verizon acknowledges that all non-switched services constitute at most 10% of the services in its network, Tr. 4160 (Gansert),¹³² and Verizon presents no forecast suggesting that unbundled loops would take up the additional UDLC capability.¹³³ Thus, it cannot be presumed that the high level of UDLC that Verizon assumes in its own Model is appropriate for use in the Synthesis Model even if Verizon were correct that UDLC is required for non-switched services and for unbundling.

The mix of DLC technology advocated by Verizon for use in its own models is inappropriate even for these models. First, Verizon bases the amount of UDLC in its models on the amount it has deployed over the past three years and has even less justification for the

¹³¹ At most, UDLC would be needed for non-switched services that require connection of copper to fiber; even Verizon does not claim UDLC is needed to connect copper to copper or fiber to fiber. Similarly, at most, UDLC would be needed for unbundled loops that are not part of UNE-P. Even Verizon does not claim that loops that do not have to be connected to a collocation cage require UDLC for unbundling.

¹³² In any event, the cost of using UDLC for non-switched services should be attributed to the those services, not to a 2-wire or 4-wire analog loop. AT&T/COM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 23.

¹³³ And even for these loops, there would be no need to transfer the loop to UDLC; instead, the UDLC capability of the IDLC system could be used. AT&T Ex. 122 (Telcordia Notes on the Network, Oct. 2000) at 12-54. Mr. Gansert acknowledges that unbundling could occur using the GR-303 operational capability through UDLC while avoiding all security concerns. Tr. 4176-84 (Gansert). Verizon's current deployment of UDLC is not an accurate estimate of the UDLC would be required for such a process. Currently, Verizon does not deploy significant amounts of GR-303 in Verizon East and thus does not use the method of unbundling described by Mr. Gansert.

amount of GR-303 in its models. Tr. 4154-59.¹³⁴ Verizon's own planning guidelines, including its 2000 planning guidelines, show that Verizon will deploy GR-303 in the future. Thus, Verizon cannot estimate the DLC mix it will deploy in the next three years from what it has deployed in the past. Second, the mix of DLC technologies Verizon will deploy over the next three years is largely determined by the constraints of Verizon's existing switches and by the fact that Verizon has decided not to deploy significant amounts of GR-303. But the modeling process assumes deployment of new switches, an increased use of fiber as opposed to copper, and deployment of large amounts of DLC all at once. This makes it difficult to determine how to evaluate the DLC mix that should be used in Verizon's models given the forward-looking model requirements. Tr. 4557 (Murray). But it is clear that CLECs should not be required to pay for all new switches and increased fiber and then be required to pay for a more expensive DLC mix that results from the constraints of Verizon's existing switches and incremental deployment of DLC technology. It makes far more sense to conclude that an ILEC using all new switches would adopt the most efficient DLC technology – GR-303 even within the constraints of Verizon's models.

b. DLC Input Values

The Synthesis Model uses a lower input for DLC hardware costs than was used by the Commission. Verizon disputes the use of the lower costs. Verizon Exh. 109 (Murphy Reb.) at 110. As Mr. Riolo explained at length, however, the DLC line card input values used in the Synthesis Model exceed those in a recent market forecast report prepared by the RHK company, and, even more important, the DLC input values as a whole exceed the DLC costs in Verizon's own purchasing contract with Litespan. AT&T/WCOM Exh. 6 (Riolo Dir.) at 13-36; AT&T/WCOM Exh. 18P (Riolo Surreb.) at 12-14.

¹³⁴ Verizon did not perform any optimization routine to determine the mix of fiber and copper or GR-303 versus TR-008. Tr. 3100-01, 3137-38.

c. Concentration of GR-303

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In the Synthesis Model, AT&T and WorldCom did not change the 1:1 concentration ratio used by the FCC in its calculation of costs for universal service purposes. As a result, the Synthesis Model *overstates* costs.

d. EF&I Factors

Verizon applies Engineer, Furnish & Install (“EF&I”) loadings to its digital loop carrier equipment costs. Thus, for example, Verizon increases the costs of plug-in equipment by [BEGIN VERIZON PROPRIETARY] [REDACTED] [END VERIZON PROPRIETARY] to account for the cost of installation. But even Verizon acknowledges that the cost of installing plug-ins is very small. And Verizon’s own data on EF&I show that the EF&I for plug-ins is [BEGIN VERIZON PROPRIETARY] [REDACTED] [END VERIZON PROPRIETARY]. AT&T/WCOM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 75. AT&T and WorldCom have therefore reduced the EF&I for plug-ins in restating Verizon’s costs.

Verizon's proposed fill factors for its own models, cannot be imported into the Synthesis Model. Those fill factors are largely based on Verizon's purported experience in its existing network, after breakage has occurred. They are not target fill factors. Nor are these fill factors disaggregated by density zone, as would be required for use in the Synthesis Model. Tr. 4494-96 (Baranowski); *id.* (Gansert) ("It's really a totally different use of the utilization factor.")

Moreover, Verizon's fill factors, based on its embedded network, provide even more spare capacity for growth than the Synthesis Model fill factors. If there were more spare capacity in the Synthesis Model to account for growth, prices would also have to be based on the anticipated demand for that spare capacity. The Commission has explained the importance of consistent calculation of capacity and demand:

[T]he synthesis model currently calculates the average cost per line by dividing the total cost of serving customer locations by the current number of lines. Because the current number of lines is used in this average cost calculation, we agree with AT&T and MCI that the total cost should be determined by using the current number of customer locations. As AT&T and MCI note, 'the key issue is the consistency of the numerator and denominator' in the average cost calculation.

Universal Service Tenth Order ¶ 56 (*citation omitted*).

Verizon advocates adding additional capacity to the Synthesis Model through use of lower fill factors without spreading the cost of that capacity over additional demand. This would result in overrecovery of costs.¹³⁶ As the Commission explained, "[I]f we were to

Moreover, both this Commission and state commissions have determined that vacant units do not need to be included in cost studies. *Universal Service Tenth Order* ¶¶ 56-59 (noting importance in consistency in development of total lines and total cost and rejecting use of housing units instead of households in cost calculation). AT&T/WCOM Exh. 14P (Pitkin Surreb.) at 41-42.

¹³⁶ Consider a fictitious network consisting of 100 customers that is expected to last for 10 years. Feeder plant could serve those customers for \$100,000, but the feeder plant could also be

calculate the cost of a network that would serve all potential customers, it would not be consistent to calculate the cost per line by using current customer demand. In other words, it would not be consistent to estimate the cost per line by dividing the total cost of serving all potential customers by the number of lines currently served.” *Universal Service Tenth Order* ¶ 58. *Accord*, AT&T Exh. 100, A. Kahn, *The Economics of Regulation* at 121; *Local Competition Order* ¶ 682 (directing that fill factors reflect “the total cost of the element” divided by a “reasonable *projection* of the actual total usage of the element”)

If additional capacity were built into the Synthesis Model and the cost of that capacity were spread over expected demand, the net result would be lower, not higher costs. The reason a carrier builds excess capacity for growth is that it is less expensive to construct that capacity today on a net present value basis than it would be to construct that capacity tomorrow, taking into account projected demand. AT&T and WorldCom have shown that if additional spare capacity were built into the Synthesis Model to serve additional years of projected demand, and the costs were spread over that demand, the cost per customer would actually decrease.¹³⁷

constructed to serve 150 customers for only \$120,000. If the company constructed the additional capacity later, the feeder plant would cost \$150,000. Although it is less expensive to construct the additional capacity now, it only makes sense to construct the additional capacity now if the network is expected to grow so that the cost per customer of the feeder plant would be less over the 10 year period. If the company charges the customers more in year 1 because it has constructed capacity to serve 150 customers and continues to charge this amount over the 10 year life of the network, it will overrecover its costs. *See* AT&T/WCOM Exh. 20 (Murray Surreb.) at 39-40.

¹³⁷ The target fill factors in the Synthesis Model provide sufficient spare capacity to allow for at least three years of growth from 2001 to 2004, the period the Model will be in effect. The Model then determines the cost per customer by dividing by the expected customers for mid-year 2002, the mid-point in the planning period. If the Model instead included sufficient capacity for growth through 2006 but spread those costs over the customers who would use the capacity over the five year period, costs would actually be ten percent lower. AT&T/WCOM Exh. 14P (Pitkin Surreb.) at 16-17.

The fill factors proposed by Verizon for use in its own models are too low.¹³⁸

With important exceptions, Verizon bases the fill factors in its studies on the purported fill in its embedded network. But Verizon understates the fill in its embedded network, fails to show its proposed levels of fill are efficient, and, even more fundamentally, proposes significant spare capacity to provide for growth without reducing its costs to account for the increase in demand that will result from that growth.

Verizon's estimate of the utilization levels in its current network is dubious at best. Verizon claims that its utilization level for copper feeder is **BEGIN VERIZON PROPRIETARY *** [REDACTED] *** END VERIZON PROPRIETARY**. During the hearings, however, Mr. White stated that he had conducted a survey of survey of 7% of the feeder routes in Virginia and found that the average feeder utilization was 80% . Tr. 4994-95, 5006-08 (White). Verizon's embedded fill also is likely lower than the fill that would exist in a reconstructed network. GTE planning documents reveal target fill factors far higher than Verizon suggests is appropriate. Moreover, Verizon's embedded network contains numerous feeder routes and other plant built to accommodate future growth that did not ultimately materialize – routes that would not exist in a reconstructed network, rendering Verizon's existing fill an inaccurate estimate of fill in a reconstructed network.

More fundamentally, when Verizon builds its real network it provides substantial spare capacity to allow for growth and presumes that growth will continue into the future. Tr. 2995 (Tardiff). When that growth occurs, some of the spare capacity that Verizon has

¹³⁸ Verizon applies utilization factors after calculating unit costs of network equipment. Thus, to determine distribution costs for a UAA with 1000 customers, Verizon picks a cable sized to the number of working lines, determines the unit cost, and then divides those costs by a utilization factor to arrive at the cost per customer. Tr. 4216-19 (Gansert). Thus, if Verizon's distribution utilization is 40%, Verizon will divide by 40% to arrive at a cost per customer because it presumes that 60% of the plant will be unused. Tr. 4221-22 (Gansert).

provided will be used up. Tr. 2995-96 (Tardiff); Tr. 4204-05 (Gansert). Yet Verizon's Model prices UNEs as if the level of spare capacity remains constant over time, as if demand does not increase. Verizon charges present customers for capacity that will be used by future customers and then *also* charges future customers for that capacity. AT&T/WCOM Exh. 11P (Murray Reb.) at 32 ("Verizon has modeled plant to meet future demand as well as current demand, but the company has calculated unit costs using only current demand in the denominator of the calculation.") In a competitive market, such a pricing strategy would be vulnerable to competitive entry by a firm that charged present customers for present demand only – or even by a firm that built a network with no spare capacity for growth and charged customers only for the capacity it had built.¹³⁹ Moreover, a firm "will not make the right investment decisions unless it bears the risk of recovering the carrying cost of today's spare capacity from future customers." AT&T/WCOM Exh. 20 (Murray Surreb.) at 39-40. If excess capacity is put into the model for growth because this minimizes the net present value of deploying the network over the life of the network, then the unit price should be based on the total demand over the life of the facility. Tr. 3212 (Murray); AT&T/WCOM Exh. 11P (Murray Reb.) at 33. Alternatively, "because such a calculation is a difficult one," a model can estimate cost by assuming capacity is not built for

¹³⁹ Verizon's experts were unable to assess whether it would be efficient for a firm that built spare capacity to assess all of those costs to current customers or whether such a firm would be vulnerable to entry from a competitor that did not charge current customers for such spare capacity. Tr. 2983-90 (Shelanski, Tardiff).

One BOC expert, however, has acknowledged that, at least as a matter of fairness, present customers should not have to pay for all of the spare capacity built for future customers: "We have already posed the question of the proper rate [of depreciation] when a plant is built far in advance of total need – perhaps because there are great economies of scale. To charge depreciation in equal annual installments would be to impose a disproportionately heavy burden on customers in earlier years, when much of the capacity lies idle. Considerations of fairness – the idle capacity is really for the benefit of future, not present customers – and economic efficiency present a case for something similar to SRMC pricing, which would have the effect of concentrating the capital charges in later years." AT&T Exh. 100, A. Kahn, *The Economics of Regulation* at 121.

growth and not accounting for the revenues that would result from utilization of that capacity. AT&T/WCOM Exh. 20 (Murray Surreb.) at 40; *Universal Service Tenth Order* ¶ 58 (refusing to include future demand because of the speculative nature of that demand.).

It is no answer to say, as Verizon repeatedly does, that the average fill factors in its network have remained constant over time. The capacity that Verizon accounts for in its pricing models would get used after it was built. The fact that Verizon simultaneously would build additional capacity to serve additional demand, thus keeping utilization levels in its network constant, is irrelevant because this additional capacity and demand is not modeled.

Verizon argues that some of the spare capacity in its embedded network is necessary for administration and maintenance and is not built to prepare for future growth. Verizon Exh. 122 (Verizon Recurring Cost Panel Surreb.) at 105. Spare capacity is also needed, according to Verizon, to meet Virginia Commisison requirements so it can respond quickly and flexibly to service orders. *Id.* at 107-14 But Verizon nowhere even attempts to demonstrate that the fill factors proposed in AT&T/WorldCom's restatement of Verizon's models are insufficient to provide sufficient spare capacity for administration, maintenance, and response to service orders. A 60% fill for distribution plant, for example, provides substantial spare capacity to serve these purposes. Although Verizon suggests that any fill factor higher than that which exists in its embedded network would be insufficient to meet the requirements of the Virginia Commission, that very Commission adopted a fill factor of 50% for distribution plant in the prior Virginia UNE proceeding. AT&T/WCOM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 44.

Finally, it is important to note that the fill factors used as inputs in Verizon's models not only deviate from sound economic principles, they also deviate from Verizon's own engineering definition of fill. Although Verizon calculates fill by dividing working pairs by all

pairs, Verizon's engineers calculate fill by dividing working, idle dedicated, and defective plant. AT&T/WCOM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 48-50. Thus, if a pure engineering definition were used, fill would also be substantially above that used by Verizon in its models for yet another reason.

a. Copper Distribution Cable in the Synthesis Model

The Synthesis Model uses the target fill factors for copper distribution adopted by the Commission as forward-looking in its USF proceeding. Verizon criticizes these fill factors but never sets forth what the effective fill factors should be. The Synthesis Model target fill factors for distribution cable are 50-75%, and the effective fill factor (averaged across density zones) is 52.5%. AT&T/WCOM Exh. 14P (Pitkin Surreb.) at 13-14. Although Verizon states that a network built using the Synthesis Model's distribution fill would have insufficient capacity to accommodate demand fluctuations and customer churn and does not account for facilities at vacant premises, Verizon Exh. 109 (Murphy Reb.) at 86, Verizon never states how much spare capacity is needed for these purposes and why the Synthesis Model's spare capacity is insufficient. The Virginia Commission obviously believed that distribution fill similar to that in the Synthesis Model was sufficient when it adopted a 50% fill in the first Virginia UNE proceeding. Moreover, as Mr. Riolo explained, he personally directed operations that had a fill factor in excess of the effective fill in the Synthesis Model, and, in examining Verizon's estimate cases for maintenance operations, found parts of Verizon's plant that operated above the effective fill in the Synthesis Model. Tr. 4514-15 (Riolo). Clearly that fill was sufficient to meet demand fluctuations and provide for customer churn.

With growth in demand in Verizon's network averaging 3% per year, an effective fill factor of 52.5% also provides substantial spare capacity to allow for growth of second lines and other growth in customer demand. *Cf. Universal Service Tenth Order* ¶ 201 ("Significantly,

we note that, contrary to GTE's inference, current demand as we define it includes an amount of excess capacity to accommodate short-term growth."); *id.* ¶ 203 (rejecting Bell Atlantic's claim that fill factors should be lower because there was no evidence that such fill factors were insufficient to meet current demand plus some growth). Verizon argues that the Synthesis Model does not guarantee that at least one additional distribution pair is allocated to each subscriber location. Verizon Exh. 109 (Murphy Reb.) at 85. By providing almost one additional line for every working line, however, including every second and third line that is working, the Synthesis Model does provide, on average, more than two pairs per household. Verizon states that the average lines per household in Virginia is 1.18. Tr. 4192-93 (Gansert). With an effective fill factor of 52.5%, therefore, the Synthesis Model actually constructs an average of 2.25 lines per household.

As a result, the Synthesis Model substantially overstates the price of distribution plant. By constructing an average of 2.25 lines per household, the Model constructs sufficient capacity to serve many years of growth. But the Model does not cost that capacity by dividing all projected demand over the life of the loop plant. The Model costs distribution plant based on the demand projected for mid-year 2002, not the mid-point in the projected life of the plant constructed in the Synthesis Model.

b. Copper Distribution in Verizon's Model

Verizon also understates the distribution fill that should be used in its own models. Verizon bases its copper distribution fill factor on the fill levels it claims are currently experienced in its embedded network. Verizon asserts that this level is [BEGIN VERIZON PROPRIETARY] [REDACTED] [END VERIZON PROPRIETARY]. This is undoubtedly not Verizon's actual fill, but even if it were, that fill factor would be entirely inappropriate as a basis of assessing cost.

In allocating costs, Verizon divides the costs of the loop plant in its models by the number of working lines and then divides the resulting number by the fill factor. The effect is to calculate costs as if Verizon constructed [BEGIN VERIZON PROPRIETARY] working pairs. AT&T/WCOM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 44-45. This is far more than the two pairs per household called for by Verizon's Engineering Guidelines.

Moreover, Verizon does not establish that it is efficient to construct two pairs per household. Although Verizon claims this guideline has been universally used by ILECs for many years, [BEGIN VERIZON PROPRIETARY] In the many neighborhoods in which demand for second lines has remained stable and is likely to remain so going forward, there is no need to construct two distribution pairs per household. Far fewer distribution pairs could be built while still providing sufficient capacity to serve any demand for second lines that did arise. AT&T/WCOM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 46-47. This is particularly so in a world in which the advent of

DSL has reduced customers' need for second lines. *Cf. Universal Service Tenth Order* ¶ 200 (noting that ultimate demand may decrease substantially with advent of DSL).

Outside the context of distribution plant, Verizon conducts economic analyses to determine how much spare capacity should be built to serve likely future growth in demand. Tr. 4113-14 (Gansert) (describing calculation for feeder). Clearly, similar analyses should be undertaken with respect to distribution plant. Instead of doing such analyses, Verizon claims that "perfect omniscience" is not possible and that "neighborhoods demand changes over time." Verizon Exh. 122 (Verizon Recurring Cost Panel Surreb.) at 120-21. While it is always possible that demand could change significantly, that does not mean that it is efficient to construct spare capacity to provide for all possible increases even where such an increase is highly unlikely.

Even if the fill in Verizon's embedded network were taken as a starting point, however, the fill factor would have to be adjusted to account for the substantial number of defective pairs in its existing network – a number that would be far lower in a reconstructed network. In calculating its existing fill factor, Verizon divides working pairs by total pairs, including defective pairs. Verizon has acknowledged that **[BEGIN VERIZON PROPRIETARY]** [REDACTED] **[END VERIZON PROPRIETARY]** of the pairs in its network are defective. AT&T/WCOM Exh. 12 (AT&T/WorldCom Recurring Cost Panel Reb.) at 63. But in a reconstructed network with new plant, there should be fewer than 1% defective pairs. *Id.* at 47; Tr. 3893 (Riolo).¹⁴⁰ Verizon does not dispute this. But this fact alone means that the distribution fill factor should be significantly higher than Verizon claims. Indeed, when the various factors set forth above are considered, the distribution fill factor of 60% proposed by

¹⁴⁰ Contrary to Verizon's suggestions, a new network with fewer than 1% defective pairs is entirely realistic. Indeed, GTE's planning guidelines state that "Feeder facility non-repairable bad pair allowance will not exceed 2%-Urban and 3%-Rural for any working base fill) or project trigger calculation. Distribution facility non-repairable bad pair allowance will not exceed 1%." AT&T Ex. 117 at E1.

AT&T and WorldCom in adjusting Verizon's studies is conservative – even if it were appropriate to build substantial spare capacity for future growth into the models and charge present customers for that capacity. AT&T/WCOM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 45.

The biggest problem with Verizon's fill factor is its reliance on fill in its embedded network and its construction of distribution facilities to serve ultimate demand.¹⁴¹ Tr. 2999-3000 (Tardiff). Verizon then calculates UNE prices as if current customers would pay for all of that spare capacity built to serve future demand.¹⁴² Verizon contends that it is efficient to build to ultimate demand because of economies of scale associated with constructing all distribution plant at once. Verizon Exh. 122 (Verizon Recurring Cost Panel Surreb.) at 123-24. But even if this were so, that does not mean that present customers should pay now for all the distribution plant, AT&T/WCOM Exh. 12P (AT&T/WorldCom Recurring Cost Panel Reb.) at 45-46, or continue to pay for all the spare distribution plant as demand for that plant materializes. Charging present customers the full cost of spare capacity leads Verizon to overrecover its costs as demand for that plant materializes.

Consider, for example, the drop to the customer's location. In its embedded network, Verizon constructs two pairs to each location even if the customer only has ordered one pair. In its cost models, by applying a fill factor based on fill in the embedded network, Verizon charges the customer for the second pair even though the customer is not using the second pair.

¹⁴¹ Verizon states that “distribution utilization is driven primarily by factors that are unrelated to growth. For example, . . . one of the primary determinants of distribution utilization is customers' current (or foreseeable) need for second lines.” Verizon Exh. 122 (Verizon Recurring Cost Panel Surreb.) at 118-19. But constructing spare capacity to provide second lines is constructing spare capacity for growth – albeit growth of demand from customers already using one line.

¹⁴² Because Verizon builds to ultimate demand, there is no need to build any additional plant as demand increases. Tr. 3000 (Tardiff); Tr. 4115 (Gansert). Instead, the utilization of the plant increases over time.

If the customer begins using that pair, Verizon does not provide the second pair for free but instead charges the customer the same price for the second pair as for the first pair, including the costs associated with application of a fill factor to the second pair. In effect, when the customer orders a second pair, Verizon charges the customer as if the customer needed four pairs. During cross-examination, Verizon's witnesses were unable to explain why the customers should have to pay anything for the second pair when the customer has been paying for that pair all along. Tr. 2932-38 (Tardiff, Shelanski).

As discussed above, a pure economic analysis would require constructing whatever spare capacity is efficient to provide for growth but charging customers based on expected demand. An approximation of this – although one that results in excessive charges – is to include little spare capacity for growth. *Cf. Universal Service Tenth Order* ¶ 199 (“the fill factors selected for use in the federal mechanism generally should reflect current demand and not reflect the industry practice of building distribution plant to meet ‘ultimate’ demand.”) The fill factor for distribution resulting from such an analysis – in which customers were charged only for working pairs, pairs reserved for maintenance purposes and other pairs needed to operate the network today would be in the order of 90%. AT&T/WCOM Exh. 12 (AT&T/WorldCom Recurring Cost Panel Reb.) at 45-56. Verizon's fill factor is therefore far too low, and even the fill factor used by AT&T and WorldCom in their restatement is extremely conservative because it provides substantial spare capacity for growth.

In the Massachusetts 271 Order, the Commission questioned the appropriateness of Verizon's proposed 40% fill factor in the absence of a state-specific justification. It noted that higher fill factor had been adopted in the USF proceedings and by other state commissions.¹⁴³ Verizon has not provided a state-specific justification for such a low fill factor here.

¹⁴³ Memorandum Opinion and Order in Verizon Massachusetts Application for Section 271 Relief, CC Docket No. 01-9, FCC 0-130, rel. April 16, 2001 at ¶ 39.

c. Copper Feeder Utilization in the Synthesis Model

The Synthesis Model's target fill factors for copper feeder cable range from 70% to 82.5% and were selected by the Commission in the USF proceeding. *Universal Service Tenth Order* ¶ 207. The effective fill factors will be lower after breakage is taken into account. This is extremely conservative. Verizon's own Engineering Guidelines require sufficient spare capacity to provide for three to five years of growth. Given that growth in Verizon's network has been averaging 3% per year, the fill factors in the Synthesis Model for copper feeder easily meet these Guidelines.

Verizon contends that the copper feeder fill factors in the Synthesis Model are insufficient to meet the requirements of its Engineering Guidelines, an argument the Commission rejected in the USF proceedings. *Id.* ¶ 207. Nonetheless, Verizon contends that these Guidelines require provision of 15% spare capacity for administrative and maintenance needs and additional spare capacity for three to five years of growth. Verizon Exh. 109 (Murphy Reb.) at 87. *But cf.* Verizon Exh. 122 (Verizon Recurring Cost Panel Surreb.) at 125-26 (describing need for an administrative spare of 9% to 15% of total capacity). Even if Verizon were correct that, on average, 15% spare capacity were needed for administrative purposes, and capacity for three years of growth at an average of 3% per year were provided on top of that, a fill of 76% would still be sufficient prior to breakage (70% with five years of growth). The fill factors in the Synthesis Model would therefore need little, if any, correction.

Moreover, Verizon is incorrect that an efficient carrier would provide 15% spare administrative capacity for copper feeder. According to GTE's planning guidelines, the relief triggers for feeder – the point at which the engineer begins considering providing relief for the feeder route – are typically well above 90%. AT&T Ex. 117 at E2-3. And even once the engineer begins considering providing relief to a route, this does not mean he will provide relief immediately. "In general, the engineer will not provide for provisioning of new facilities until